MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

DBM5114 – BUSINESS MATHEMATICS

(All sections / Groups)

6 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **SIX (6)** printed pages with 4 questions only, excluding the cover page.

2. Attempt **ALL FOUR (4)** questions.

3. Write all your answers in the answer booklet provided. All necessary workings **MUST** be shown.

4. Mathematical formula is attached at the end of this question paper.

Question 1 (25 marks)

(a) Perform the indicated operation and simplify the answer.

(i) $\left(3x^2+5x-6\right)+\left(3x^2-x+3\right)$

[3 marks]

(ii) $\dfrac{x+1}{x+3}+\dfrac{x-4}{x-1}$

[4 marks]

(b) Find the value of x.

(i) $4\left(x-3\right)+3\left(5x-1\right)=x$

[4 marks]

(ii) $x+7\left(2x+5\right)\le 2\left(-x+2\right)-1$

[4 marks]

(c) The total costs for a company are given by $C\left(x\right)=200+10x$ and the total revenues are given by $R\left(x\right)=50x$ where x is the number units produced daily. Find:

(i) the profit function,

[3 marks]

(ii) the break-even points.

[7 marks]

Question 2 (25 marks)

(a) Find the optimal solution for the following Linear Programming model.

$$\begin{aligned} \text{Maximize} \quad & P=12x+20y \\ \text{Subject to} \quad & 3x+2y\le 60 \\ & 4x+y\le 72 \\ & x\ge 0, y\ge 0 \end{aligned}$$

[16 marks]

(b) Find the semiannually payment required to accumulate a sum of RM17450 over 6 years with interest earned at the rate of 12% per year compounded semiannually.

[6 marks]

Continued...

(c) Find the effective rate of interest corresponding to a nominal rate of 8.1% per year compounded monthly.

[3 marks]

Question 3 (25 marks)

(a) Given that $\boldsymbol{A}=\begin{bmatrix}1 & 3 & 4\\ 0 & -5 & 2\\ 2 & 3 & 1\end{bmatrix}$ and $\boldsymbol{B}=\begin{bmatrix}-1 & 3 & 2\\ 0 & 5 & 2\\ -2 & 3 & 1\end{bmatrix}$. Find

(i) $2\boldsymbol{A}+9\boldsymbol{B}$,

[7 marks]

(ii) $\boldsymbol{AB}$.

[3 marks]

(iii) $(\boldsymbol{AB})^T$

[2 marks]

(b) Consider the following system of equations.

$$x+2y=4$$
$$2x-2y=6$$

(i) Write the system of equation above in a matrix form.

[3 marks]

(ii) Find the determinant and the inverse of matrix $\boldsymbol{A}$.

[6 marks]

(iii) Find the value of x and y.

[4 marks]

Question 4 (25 marks)

(a) Find the derivative of the following functions. Simplify your answer.

(i) $y=3x^5-2x^4+3x^3-x^2$

[4 marks]

(ii) $y=\left(3x^2+5\right)\left(7x^3+1\right)$

[6 marks]

(iii) $y=\left(3x^2+2x-1\right)^7$

[5 marks]

Continued...

(b) The monthly demand for a product is given by $p = 23x + 35$ where x is the number of units and p is the price per unit. Find the marginal revenue function.

[4 marks]

(c) Solve the following integral:

$$\int \frac{1}{\sqrt{2x+1}}\, dx.$$

[6 marks]

End of Questions.

Subject Code: DBM5114
Subject Name: Business Mathematics

Summary of Principal Formulas and Terms

1. Inverse of a 2×2 matrix

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A^{-1} = \frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ where $ad - bc \neq 0$

2. Determinant of a 3×3 matrix

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = a_{11}\begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} - a_{12}\begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix} + a_{13}\begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}$$

3. Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P(1 + rt)$

4. Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$
(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

5. Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

6. Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$

(S = future value of ordinary annuity of n payments of R periodic payment)

Continued...

7. Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$

(P = present value of ordinary annuity of n payments of R periodic payment)

8. Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$

(R = periodic payment on a loan of P to be amortized over n periods)

9. Sinking Fund Formula

$$R = \frac{Si}{(1+i)^{n}-1}$$

(R = periodic payment required to accumulate S over n periods)

10. Basic Rules of Differentiation

(a) Derivative of a constant: If $f(x)$ is a constant, then $f'(x)=0$

(b) Power rule : If $f(x)$ is x^n, then $f'(x)=nx^{n-1}$

(c) Constant multiple rule: $\frac{d}{dx}\left[cf(x)\right]=cf'(x)$ (c is a constant)

(d) Sum rule: $\frac{d}{dx}\left[f(x)\pm g(x)\right]=f'(x)\pm g'(x)$

(e) Product rule: If $f(x)=u(x)\cdot v(x)$, then $f'(x)=u(x)v'(x)+v(x)u'(x)$

(f) Quotient rule: $f'(x)=\frac{d}{dx}\left[\frac{u(x)}{v(x)}\right]=\frac{v(x)u'(x)-u(x)v'(x)}{\left[v(x)\right]^2}$

(g) Chain rule: $\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}$

(h) General power rule: $\frac{d}{dx}\left[f(x)\right]^n=n\left[f(x)\right]^{n-1}f'(x)$

(i) Exponential function: $\frac{d}{dx}\left(e^x\right)=e^x$

$$\frac{d}{dx}\left(e^{f(x)}\right)=e^{f(x)}\left[f'(x)\right]$$

(j) Logarithmic function: $\frac{d}{dx}\left(\ln x\right)=\left(\frac{1}{x}\right)$

$$\frac{d}{dx}\left(\ln f(x)\right)=\frac{f'(x)}{f(x)}$$

Continued...

11. Basic Rules of Integration

(a) Indefinite integral of a constant: $\int k\ dx = kx + C$

(b) Power rule: $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

(c) Constant multiple rule: $\int kf(x)\ dx = k\int f(x)\ dx$ where k is a constant

(d) Sum rule: $\int [f(x) \pm g(x)]\ dx = \int f(x)dx + \int g(x)dx$

(e) Exponential function: $\int e^x dx = e^x + C$

(f) Logarithmic function: $\int \left(\frac{1}{x}\right) dx = \ln x + C$

12. Areas between Curves

$$A = \int_a^b [f(x) - g(x)]\ dx$$

End of Page.